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EXAMINER
CHANG, AUDREY Y

ART UNIT	PAPER NUMBER
2872	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/530,968	GROSSETIE ET AL.	
	Examiner	Art Unit	
	Audrey Y. Chang	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2006 and 11 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-16 and 18-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4,6-14 and 18-25* is/are rejected.

7)☒ Claim(s) *2,3,15 and 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendments filed on April 24, 2006 and May 11, 2006 which have been entered into the file.
- By these amendments, the applicant has amended claims 1,6-8, 10, 14,18-20 and 22 and has canceled claims 5 and 17.
- Claims 1-4, 6-16, and 18-25 remain pending in this application. *The applicant is respectfully noted that the dependence of claims 10 and 22 are wrong for claims 5 and 17 have been canceled.*
- The rejections to claims under 35 USC 112, first paragraph, with regard to newly added matters are withdrawn in response to applicant's amendment.
- The rejections of claims 7-8 and 19-20 under 35 USC 112, second paragraph, set forth in the previous Office Action are withdrawn in response to applicant's amendment.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. **Claims 1, 4, 6-14, 18-25 are rejected under 35 U.S.C. 112, first paragraph,** as failing to comply with the **enablement** requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The phrase "computing a set of two-dimensional images representing the object as seen from respective different viewpoints in the three-dimensional geometric space each of said two-dimensional images representing the object as seen from one of said different viewpoints in the three-dimensional geometric space" recited in **claims 1 and 14** is **not enable** by the specification. The specification **fails** to teach that the set of two-dimensional images are produced at ANY place in the three dimensional geometric space and it **fails** to teach that the two-dimensional images used to calculate the elementary holograms are viewed from ANY viewpoints in the three-dimensional geometric space. Rather the specification **ONLY** gives support for the two dimensional images being defined in a *particular first geometric plane* and the images are defined by viewing the object from different view points **located in a specific** *second* geometric plane, wherein the first and second geometric planes are parallel to each other, so that the set of two dimensional images is determined by the *projection* of the object on the first geometric plane as viewed from the plurality of different viewpoints on the second plane. Off from this condition, the elementary holograms cannot be formed to reproduce the object, (please see Figure 4 and pages 2-3). The specification also does not give any support for producing the hologram from conditions different from the above-mentioned condition.

Claim Objections

3. **Claims 1-4, 6-16 and 18-25 are objected to because of the following informalities**:

(1). Claims 1 and 14 have been amended to include the phrase "two dimensional image comprises coordinates (Y, Z) and is defined by..." that is confusing and indefinite since it is not clear what are these coordinates and how are these coordinates defined? Coordinates are mathematical abstract objects that have no physical meaning therefore do not provide a logical limitations to the claims.

(2). The phrase "the corresponding real function" recited in claims 1 and 14 and the phrase "said real function" recited in claims 6 and 18 in light of the amendment is confusing and indefinite since it lacks proper antecedent basis.

(3). The amended phrase "*simulating* illuminating the oversampled complex image by an optical wave (DIF) to obtain a diffracted image" should be better versed as "*Calculating* a diffracted image (84_{mn}) by *simulating* the illumination of the oversampled complex image (83_{mn}) by an optical wave (DIF)". Simulation of the illumination will not be able to obtain the diffracted image. A calculation is required and necessary to obtain the diffracted image, as claims 7-8 and 19-20 explicitly indicated.

(4). The phrase "extracting (E6) amplitude values of the sum of said complex field and the resulting diffracted image to produce hologram" recited in claims 1 and 14 is wrong the hologram is not produced by the amplitude values of the sum but rather it is the amplitude values of the **interference field. (The applicant is respectfully noted that the sum of these two terms will produce amplitude value for the transmittance of the diffracted image and the reference wave also. However it is the interference field between the two functions that contributes to the hologram.).**

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 4, 6, 7-8, 9-13, 14, 18-20, and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the article "Fourier-transform computer-generated hologram: a variation on the

off-axis principle" by Michelin et al (SPIE Vol. 2176, Practical Holography VIII (1994) pages 240-254) in terms of the patent issued to Saito et al (PN. 5,668,648).

Michelin et al teaches a computer-generated hologram to generate arbitrary optical wavefronts and to create image of *virtual* objects wherein elemental hologram is computed based on two-dimensional **image information f** (please see object plane, Figure 1) of the virtual objects. The two-dimensional image information f is sampled by a function f(x,y) on the object plane and it implicitly represents a perspective view of the object from a viewpoint in the three dimensional geometric space. Michelin et al teaches that that a Fourier transformation is performed on the image function f(x,y) to simulate the object beam, i.e. the object information modulated beam, to obtain the *diffracted image*. The diffracted image $F(u,v)\exp(i\phi(u,v))$ is then added to a complex field $A\exp(2\iota\pi au)$ that represents a reference optical wave to produce the interference field, (please see page 250), such that by obtaining the **amplitude** of the interference field of the sum of the complex field and the diffracted image the hologram is produced, (please see page 250).

Although the Michelin et al reference does not teach explicitly to use a set of two-dimensional image information for the object to calculate a plurality of elementary holograms, such modification would have been obvious to one skilled in the art since the modification only requires repeating the same calculation process for different two-dimensional image information for the benefit of producing a composite hologram from a composite two-dimensional image information.

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that an oversampling step to the complex image is performed. The image information f is implicitly complex function. **Saito et al** in the same field of endeavor teaches a computer-assisted holographic display apparatus that is comprised of a *diffraction image computation section* (12) for receiving an input image data signal that represents a three dimensional object (20) and to compute the corresponding *diffraction pattern data* with a first sampling density. The apparatus further comprises

second computation section that is connected to the diffraction image computation section to subject the diffraction pattern data to the *interpolation process* (28) so as to created *interpolated diffraction pattern data* with a *second sampling density* that is *increased* (i.e. an oversampling process), before the interference image or field is calculated, (14). It would then have been obvious to one skilled in the art to apply the teachings of Sato et al to modify the calculation step of Michelin et al by adding oversampling image processing step for the benefit of improving the image quality.

Claims 1 and 14 have been amended to include the feature that each of the two-dimensional images comprises coordinates and is defined by an intensity distribution. Michelin et al teaches that the image of the object has coordinates (x, y) and has intensity profile or distribution of f(x, y). The real intensity distribution is then converted to complex image function by using Fourier transformation, (please see page 250, third paragraph).

Saito further teaches, with regard to claims 10-11, 22-23 and 26 that the computer-generated holograms are displayed on a *spatial light modulator* (16, Figure 1) wherein light source may be used to physically reproduce the hologram image of the object. With regard to claims 12-13 and 24, light sources of different color can be used to reproduce holograms of different colors, (please see Figure 12). It would then have been obvious to apply the teachings of Sato et al to represent the calculated hologram on the spatial light modulator to actually implement the hologram.

With regard to the feature (as recited in claims 6 and 18), concerning "said amplitude value each depending on the square root of a corresponding intensity value taken by the real function of the given two-dimensional image". Such feature is implicitly included in the wave theory of the image light, wherein intensity of the image light wave is the absolute square of the amplitude value of the wave function.

Response to Arguments

6. Applicant's arguments filed on April 24, 2006 have been fully considered but they are not persuasive. The amendment to the claims have been fully addressed and they are rejected for the reasons stated above.

7. **In response to applicant's arguments concerning the "enablement" rejections the examiner wishes to state the following:**

Firstly, the applicant is respectfully noted that the **specification is required** to provide adequate teachings and enablement of **every possibility** covered by the claims, for otherwise the claims are not supported by the specification and claims do not faithfully representing the invention. Does this means the applicant also agree that the feature in question is not supported by the specification?

Secondly, the specification **only gives support** for the view points being located in a first geometric plane (7, Figure 4) and the set of images be formed as the *projection* of the object as viewed from each viewed points on a second geometric plane, (8), parallel to the first geometric plane and located in between the first geometric plane and the object. In fact the distance "D2" between the two geometric planes and the distance "D1" between the first geometric plane and the object are **essential** in the calculation of the hologram. The specification really does not give support for the calculation of the hologram when the images and the viewpoints are not each located in a single plane. The limitations concerning the scopes extended to ANY points in the three dimensional space are therefore not covered by the scopes of the specification and therefore is not enable by the disclosure of the specification.

Thirdly, applicant's arguments relying on third party reference does not provide a remedy to the lacking support of the specification of the *instant application* for the feature in question. This suggest even more that the specification **fails** to provide positive teachings and support for the feature.

The non-enabling rejections of the claims therefore stand.

8. In response to applicant's arguments which state that the cited Michelin article directed to use Fourier transformation to compute amplitude transmittance from complex fields representing reference wave and "containing to suggestion whatsoever of constructing a hologram from two-dimensional images" the examiner respectfully disagrees and wishes the applicant to study the cited Michelin article more closely. Firstly, being one skilled in the art, the applicant must understand by simply using the complex field of the reference wave, one will NOT be able to compute a hologram, applicant's reading of the cited reference is therefore wrong. Secondly, the applicant is respectfully noted that Michelin teaches to compute the hologram by computing the amplitude value of the interference field of the sum of the reference wave ($Ae^{2i\pi au}$) and the object field or the "diffracted image" ($F(u, v)e^{i\phi(u,v)}$), (please see page 250), wherein the complex image ($F(u, v)e^{i\phi(u,v)}$) is obtained from the two dimensional image f(x,y) by performing complex transformation such as Fourier transformation. The hologram is therefore computed from the two dimensional image of the object. Without two dimensional image information of the object, it is impossible to compute the hologram for representing the object. The two dimensional image therefore also has to represent the entire object in order to compute the hologram that is capable to reproduce the image of the entire object.

9. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The ideas of using element hologram or image elements to produce composite hologram of image are common sense to not just one skilled in the art but common man.

Allowable Subject Matter

10. Claims 2-3, and 15-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject matter: of the prior art references considered none has disclosed a method and system for producing a hologram from a virtual object defined in a three-dimensional space (x,y,z), wherein x, y, z representing the Cartesian coordinates, the method comprises the step of defining a first geometrical plane with a matrix of points defined within such that each of the points representing one of different viewpoints, defining a second geometrical plane parallel to the first plane, and computing a set of two-dimensional images corresponds to the projected images of the object on the second geometric plane as respectively viewed from each of said viewpoints distributed on the first plane. The method further comprises the step of computing a set of elementary holograms each corresponding to one of said two-dimensional images. Each of the two dimensional images is defined by a real function (f_{mn} (Y,Z)) representing the intensity field of the image on the second geometric plane having coordinates (Y,Z). The method further comprises the steps of converting the real function into a complex function therefore form complex image, oversampling the complex image, computing diffracted image by simulating the illumination of an optical wave (DIF) on the complex image, calculating an interference field by adding the diffracted image with a complex field representing a reference optical wave (REF) and the step of extracting amplitude values from the calculated interference field to produce the hologram associated with said given two-dimensional image, as explicitly stated in claims 1 and 14.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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